REVIEW ARTICLE

Healthcare Information Systems (HIS): Implementation Challenges in Developing Countries

Shafiqur Rahman[1], Aminul Islam[2]

ABSTRACT

In developing nations, the establishment of sustainable healthcare information systems (HIS) is often hindered by insufficient government policies and outdated technology. Bangladesh is a notable example where many patients lack proper healthcare access due to fragmented and non-digitally recorded data. Research has shown that standardized hospital healthcare systems can streamline patient management, increasing the capacity to serve more patients simultaneously. These systems have the potential to improve healthcare in developing nations significantly. This article offers an overview of the key obstacles that impede HIS implementation in these countries. The study looked at relevant information systems literature using a systematic literature review (SLR). The systematic literature review (SLR) was governed by a review process, and relevant studies were gathered from three databases: IEEE Xplore, EBSCO Databases, and ScienceDirect. A total of 4014 papers were initially found. However, only 11 main studies were included for analysis after a careful selection procedure governed by inclusion and exclusion criteria. This study found 24 obstacles to adopting Healthcare Information Systems (HIS) in developing countries, divided into six groups. These obstacles include a lack of financial assistance, inadequate infrastructure, inadequate education and awareness, cultural and political obstacles, reluctance to change, and poor system quality.

Keywords

HIS; systematic literature review; barriers; technology

INTRODUCTION

Human rights necessitate access to treatment, and the healthcare sector, as affirmed by Hamed, El-Bassiouny, and Ternès[1], holds paramount importance globally. Governments worldwide allocate substantial portions of their budgets to healthcare annually, though, in countries like Bangladesh, such allocation for healthcare dropped from 6.2% to 4.3% of total government expenditure[2]. Information systems (IS) have permeated every facet of our lives, from education to medicine. Information technology (IT) is considered a possible catalyst for increased productivity, profitability, and efficiency, as well as for quick advancement, and the successful integration of IT in wealthy countries has generated hopeful hopes for less developed countries[3]. Information and communication technology (ICT) is acknowledged by the World Health Organisation (WHO) as having the potential to improve healthcare systems[4]. While developed nations efficiently employ information systems in healthcare, developing countries grapple with their implementation.

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Existing literature underscores the criticality of IS implementation in less developed countries. Billions in these regions face deprivation across a spectrum of resources, from natural assets to technological access[5].

This study advances our understanding of how Healthcare Information Systems (HIS) are implemented in poor nations. Its goal is to assess the existing level of HIS deployment in these environments and to pinpoint the barriers preventing the uptake of these systems. To do this, a systematic literature review (SLR) is conducted, principally using the standards set out by Kitchenham and Charters[6].

Literature review

The usage of cutting-edge technology in healthcare has increased dramatically in recent years [7]. The way we approach patient care, therapies, and the overall healthcare experience is changing due to the seamless integration of technology and medicine in this new era. Observing how robotics, machine learning, and artificial intelligence (AI) have significantly altered the industry is intriguing. Now, we're seeing everything from humanoid robots to intelligent diagnostic tools, all pointing us toward a healthcare system that is more effective, accurate, and suited to each patient's needs.

As an exciting by-product of this digital boom, humanoid robots are becoming more prevalent in various healthcare settings [8].

A study by Ahmed et al [9] found that budgetary constraints were the most significant challenge to developing and advancing HIS in Bangladesh. The study noted that the government's allocation of healthcare resources was insufficient, and the funding for HIS was limited. As a result, the implementation of HIS was slow, and the systems were not fully integrated into the healthcare delivery system.

A study by Ahsan et al.[10] noted that SHI could provide a sustainable financing mechanism for HIS in Bangladesh. The study identified the lack of financial resources as a significant barrier to developing and advancing HIS in the country. The study suggested that SHI could provide a sustainable source of financing for HIS by generating revenue for the healthcare system and providing financial support for HIS.

We must possess a well-informed understanding that can be flexibly applied with empathy, considering the specific circumstances, available resources, and the needs and conditions of patients. Our approach should be grounded in ethics and an understanding that diseases show no favouritism, affecting doctors and patients alike. Therefore, medical practice should ideally adhere to established standards but allow for necessary adjustments in unique situations, always founded on evidence-based principles [11].

A significant burden has been placed on the nation's healthcare system due to increased COVID-19 cases, leading to a rise in the need for medical supplies and services. Hospitals and other healthcare institutions have struggled to manage the surge of patients, the lack of available beds, and the scarcity of essential medical supplies. According to Ashiq K et al.[12], comprehensive data management and adopting public health legislation and regulations targeted to pandemic scenarios can operate as powerful defences in conjunction with effective disaster planning. Similar worries about continued difficulties, particularly for medical and dental students, were also reported in Bangladesh at the pandemic's start of the pandemic [13] and others.

The recovery rate for COVID-19 at Aligarh Muslim University was 71.9%, above the country's average of 56% during the pandemic's early phases in March 2020[14]. To successfully fight the continuing health crisis, Bangladesh has been aggressively trying to develop its health information system, deploy digital solutions, and improve data management skills.

Healthcare financing in Bangladesh predominantly relies on out-of-pocket payments, imposing a significant financial burden on households. The government offers limited healthcare coverage through social protection programs, such as the Health Protection Scheme for the Poorest (HSP) and the Maternal Health Voucher Scheme. Private health insurance is not widely prevalent in Bangladesh, and oversight of the private healthcare sector is lacking. The global burden of mental disorders has markedly increased over the past two decades and continues to surge, exacerbated by the COVID-19 pandemic [15,16,17].

Research objective

To investigate the obstacles documented concerning the effective implementation and acceptance of Information Systems (IS) in the healthcare sector of Bangladesh

Research questions

What impediments have been documented regarding

achieving successful implementation and acceptance of Information Systems (IS) within the healthcare context of Bangladesh?

Research Methodology

To examine and investigate the material currently accessible about the adoption and deployment of information systems in developing countries, the researchers have used the systematic literature review (SLR) technique. According to[18], the systematic literature review (SLR) technique is the most common method for locating, analysing, and synthesising available information The goal of an SLR is to thoroughly evaluate existing research on the implementation process and elements that contribute to the failure of information system implementation and to develop well-informed conclusions and insights.

For locating, assessing, and synthesising previous research, SLR stands out as the most popular and commonly used approach [19]. To answer certain research questions, researchers have successfully used SLR [20]. Software engineering and health information systems are two areas where this paradigm is heavily used [7]. SLRs focus on empirical evidence, which may have been gathered through various methods [19].

An SLR's primary goal is to produce a thorough literature review that addresses a particular research issue [20]. Planning the review, carrying out the review, and reporting the review are the three key stages of the systematic review process, according to Rai et al.[21].

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Three crucial steps should be taken into account during the planning phase: determining the research gap, developing research questions, and setting the review process, which includes choosing the right keywords and search terms [20]. According to Rai *et al.*[20], the conducting phase entails several steps, including defining the search strategy, determining available resources, developing inclusion and exclusion criteria, choosing primary studies, doing quality evaluations, and synthesizing data. Rai et al.[20] emphasize that authoring and validating the review report are part of the reporting step.

It is crucial to determine the need for a Systematic Literature Review (SLR) before starting one on a given subject [23]. The justification for an SLR should be made plain throughout the planning stage. The planning process is divided into three stages, each with a set of requirements, as was already indicated. The review procedure outlines the approach taken in carrying out the review. An initial assessment of the information systems literature was done to determine the review protocol's components. Studies by [5, 21, 22] are only a few looked at in this initial stage. This research provides the groundwork for understanding healthcare systems in underdeveloped nations.

The review process is created when the necessity for the review has been established, and the research questions

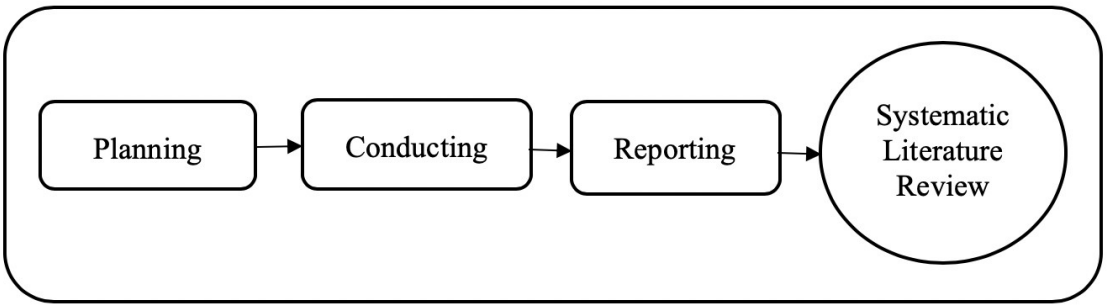

Figure 1: Systematic method of literature review [18]

have been established. According to Rai et al. [20], the review protocol describes the steps for carrying out the review, assuring the acquisition of neutral data. It includes several phases, including creating the search strategy, choosing the primary studies, evaluating the quality, and more[19] The review process for this study is included in Appendix A, and it is advised that professionals or researchers assess the review protocol [7].

The conducting phase, the actual review execution, adheres to the established procedure (see Appendix A). Research gaps must be identified, and main studies must be found from selected databases using the specified search phrases. As defined by[21], an SLR consists of several diverse activities divided into six stages, including the search strategy. The last five processes are the inclusion and exclusion procedure, primary study selection, quality evaluation, data extraction, and data synthesis. This section describes the steps in carrying out an SLR with the main objective of locating relevant primary studies associated with the research questions.

The search strategy aims to find pertinent papers closely connected with the study objectives. To find primary research, it's critical to maintain an objective search technique[24]. Three electronic databases were largely used for the collecting of studies:

a. IEEE Xplore

b. ScienceDirect

c. Ebsco Databases

We chose these databases mainly because of their extensive use in information systems and their support for complex query searches. With full-text access to publications, IEEE Xplore and Science Direct both have sizable libraries of peer-reviewed journals. As a trustworthy source of data on scientific, technological, and medical research, ScienceDirect is well-known. Ebsco databases include a range of subject areas and provide direct connections to full-text content along with an SFX link that indicates if an item is available electronically. The research questions served as a guide for creating the search string, which was then used to query the selected databases.

Identifying current systematic reviews and determining the possible applicability of research are the goals of preliminary searches[7]. Numerous relevant pieces of literature were found in each of the databases.

The search term was created using keywords extracted from the study questions. The chosen databases were then searched using the generated search query. It was required to modify the search phrase for each database to account for limits that were unique to that database and guarantee fair results. The final search term was in the following format:

("Healthcare or health") and ("developing countries" or "less developed countries") and ("Information systems" or "information technology" or "ICT" and ("barrier or failure").

The results of the final database search are shown in Table 1 below. The developed search string produced a total of 4,014 studies. The researcher reduced the choice to 729 papers using refinement criteria from 2017 to 2019.

Table 1: Search query, databases and results for this study

Search query	Database	Results from the first hit	Results after refining by years (2017-2019)
"information systems," "information technology," or "ICT," "barriers," "failure," "healthcare," "health services," or "health," and "developing countries" or "less developed countries"	IEEE Xplore	1901	277
	EBSCO host	101	15
	ScienceDirect	2012	437
	Total	**4014**	**729**

Inclusion and exclusion criteria

The selection criteria ensure that the most pertinent study materials are chosen. To ensure the applicability of the chosen articles, inclusion and exclusion criteria should align with the research questions. This will allow researchers to determine whether a publication is relevant to their study.

This study employed the subsequent inclusion criteria:

- The articles must be written in English.
- The content should revolve around 'information systems adoption or implementation in developing countries.'

- Articles offering a general discussion on health information systems adoption or implementation were considered.
- Publications within the timeframe of January 2017 to December 2019 were included.
- Eligible sources encompassed journal papers and conference papers.

This study employed the subsequent exclusion criteria:

- Articles without full-text availability were excluded.
- Articles unrelated to 'information systems in developing countries in healthcare' were omitted.
- Articles focusing on 'information systems in developed countries in healthcare' were also excluded.
- Duplicate articles were removed from consideration.
- Publications that appeared in magazines, book chapters, training materials, theses, and similar formats were not considered.

Study selection process

The process of selecting studies was a meticulous and thorough undertaking involving seven primary steps, as outlined in Table 2.

In the initial phase, the researchers searched the selected databases using the designated query, yielding 4,014 studies.

Subsequently, in phase 2, the researchers narrowed the results by specifying the year range (2017-2019), resulting in 729 studies.

Phase 3 involved the exclusion of 107 studies that comprised magazines, books, chapters, and courses, leaving 622 studies. These were then exported to RefWorks, an online reference management tool.

In phase 4, after importing the 622 studies into RefWorks, the researcher identified and removed 3 duplicate studies using the duplicate option in RefWorks, leaving 619 studies.

During phase 5, the researcher excluded studies not in English, with only one study falling into this category. This left a total of 618 studies in English.

In phase 6, the researcher applied further scrutiny by excluding 551 studies based on their title and abstracts, resulting in 67 studies remaining.

Phase 7 entailed the removal of papers that did not contain full text, reducing the total to 65 studies.

In the final phase (phase 8), the researcher comprehensively assessed the remaining papers, considering their full text and quality, ultimately determining their suitability for inclusion.

In phase 9, the researcher excluded papers that did not focus on barriers or challenges. Finally, the researchers obtained 11 papers for analyzing and reporting results.

Table 2L The steps of selecting primary studies.

Process steps	Number of excluded studies	Number of studies left
Step 1: Initial search		**4014**
Step 2: By year (2017-2019) exclude	3285	**729**
Step 3: Excluding chapters, books, journals, and courses	107	**622**
Step 4: Elimination of duplicates	3	**619**
Step 5: Not available in English	1	**618**
Step 6: Based on the title and abstract, exclude	551	**67**
Step 7: No whole text is accessible.	2	**65**
Step 8: Based on thorough text scanning and quality evaluation, exclude	46	**19**
Step 9: Leave out writings that didn't focus on obstacles or difficulties	8	**11**
Total included		**11**

After completing step 8, the researcher carefully read each article before making a conclusion using a quality evaluation checklist. In their research,[6] noted no unified definition of "study quality." However, it is of high quality when research minimises systematic flaws and maximises applicability. A quality evaluation method ensured the kept studies followed these requirements. The effectiveness of the study was assessed using six main questions. 11 publications were chosen for additional evaluation and discussion after this assessment (the list of chosen main research is in Appendix B).

Table 3: Specification for the excellence valuation [22]

Exemplary checkbox questions	Yes or no
1. Does the paper effectively and distinctly focus on its intended objective?	
2. Is the paper explicit in its presentation of the findings?	
3. Does the paper adequately and distinctly delineate the factors or barriers related to adoption?	
4. Does the paper explicitly address the topic of information systems?	
5. Is the paper unequivocal in its discussion of information systems?	
6. Is the paper explicit in acknowledging the study's limitations and delineating prospects for future esearch?	

The process of combining data that have been gathered from primary investigations is known as data synthesis[7]. The descriptive synthesis approach was used in this study to examine the data that were taken from the main research. Presenting data and findings using tables, charts, and simple language is part of descriptive synthesis. To answer the study questions, a descriptive data analysis approach was used.

The findings about the identified factors in healthcare technology will be presented in the next chapter.

Analysis and Findings

As delineated in the research methodology, only studies published between January 2017 and December 2018 were included in the systematic literature review. This search yielded 11 studies: 9 published in 2017 and 2 in 2018. Among these, 7 were journal articles, constituting 64% of the primary studies, while 4 were conference articles, representing the remaining 36%.

As shown in Table 4, the primary studies used various research techniques, including surveys, interviews, action research, literature review research, and design science research. Five of these studies—or 45%—were empirical, while the remaining six—or 55%—were not.

Table 4: Nineteen key studies' research techniques are categorized

Research Type	Number of primary studies	Percentage	Reference
Survey	3	42%	[P1], [P2], [P3]
Comprehensive literature review	6	37%	[P4], [P5], [P6], [P7], [P8], [P9]
Design science investigation	2	11%	[P10], [P11]

Table 5: Types of research are categorised

Type of study	Survey	DSR	SLR	Total
Empirical	3	2		**5**
Non-empirical			6	**6**

As shown in Table 5, five of the empirical investigations combined two different research techniques. Two studies chose the design science research (DSR) technique, whereas most studies used the survey approach. Six non-empirical investigations used techniques like the systematic literature review (SLR).

Research Countries

Various developing nations were included in the initial research, including Bangladesh, Ghana, and India. Research from other areas, including Latin America and Sub-Saharan Africa, was also highlighted. Notably, the subjects of the two experiments were not identified. These studies mostly focused on how Information Systems (IS) are widely used in healthcare. Some subjects were chosen for examination because they directly applied to emerging nations. Table 6 shows how primary studies are distributed according to the countries they focus on.

Table 6: Country use data for 19 primary studies

Country/region	Number of studies	Reference
Bangladesh	1	P[10]
Ghana	2	P[1], P[2]
India	1	P[3]
Latin American's developing countries	1	P[9]
Sub Saharan Africa	2	P[7], P[11]
Developing countries	2	P[6], P[8]
Overall countries	2	P[4], P[5]

Research focus

The initial step in this research involves categorising primary studies according to their respective research focuses. Specifically, the selection criteria employed by the researcher centred on studies that explicitly delineated the impediments or obstacles encountered. These impediments pertain to a classification encompassing elements that possess the potential to impede the adoption or efficacious implementation of

Information Systems (IS) within healthcare contexts situated in developing nations. Among the pool of primary studies considered, eleven are devoted to exploring barriers within our purview of discussion.

As an illustrative instance, Study P[6] delves into the impediments surrounding using electronic health records (EHRs) within a prosperous region in India. It is imperative to emphasize that this study, denoted as P[6], concentrates on the hurdles related to EHR employment within a specific geographic area in India. Furthermore, these obstacles are elucidated from the vantage point of information technology (IT) personnel employed within the pertinent organization.

Subsequently, within this section, the researcher categorized primary studies predicated upon their technological focus. These studies each focus on a different technology, such as electronic health records (EHRs), health information systems (HIS), mobile health (m-health), geographic information systems, e-health, telemedicine, the Internet of Medical Things, and virtual clinics. Notably, five of the nineteen papers analysed focused on EHRs when conducting their research. It is interesting to note that different studies use different terminology, with some referring to EHRs as electronic health records and others as electronic medical records (EMRs). The terms EHR and EMR are used interchangeably for this study.

Moreover, six studies delve into Health Information Systems (HIS) within the corpus of nineteen primary studies. It is pertinent to acknowledge that the definition of HIS varies among studies, with some denoting it as health information systems and others as hospital information systems. Consequently, it is imperative to clarify that, within the scope of this study, the term "HIS" encompasses health information systems while accommodating the inclusion of hospital information systems.

To clarify further, it is essential to underscore that the abbreviation "HIS" employed in this study serves as an umbrella term encompassing both health and hospital information systems. Additionally, three studies are dedicated to exploring mobile health (m-health), while five studies encompass various technologies. As a result of this diversity, these five studies have been collectively categorized as "others" within Table 7. The comprehensive classification, grounded in technological focus, is meticulously presented in Table 8.

Table 7: Grouping of primary research studies by technological emphasis

Technology name	Number of studies	Reference
HER	4	P[2], P[3], P[4], P[7]
HIS	2	P[5], P[8]
m-health	2	P[5], P[1]
Others	3	P[10], P[9], P[11]

Details about each research

Table 9 provides a thorough summary of all primary studies, including information on the publication year, paper classification (with "C" standing for conference papers and "J" for journal papers), research methodology (with "E" standing for empirical studies and "NE" for non-empirical studies), study type, geographic location, research focus, and the particular technology examined. It is important to emphasize that each research focuses on analyzing a certain technological aspect.

Study P[14] explores geographic information systems (GIS). According to [24], GIS are computer-based systems that map and analyze diverse things while smoothly integrating database features. Due to its ability to effectively manage large amounts of data, GIS is a useful tool for data integration in the healthcare industry and offers a unique data visualization method [25].

Analysis of results

The subsequent sections delineate the outcomes derived from the Systematic Literature Review (SLR) about impediments and facilitators affecting the adoption of information systems within healthcare contexts in developing nations.

Barriers

The researcher defined and grouped the barriers to adopting hospital information systems in healthcare settings in poor countries into six categories as part of this analysis. These categories are succinctly summarized in Table 10. A numerical value and corresponding percentage in this table accompany each category. The numerical value signifies the count of studies specifically addressing that particular category. To illustrate, the category of "education, training, and awareness" was addressed by seven studies, namely [P4, P6, P7, P8, P9, P10, P11]. Hence the number "7" is denoted alongside this category. The percentage for

Table 8: A thorough summary of each study

Primary study	Year	Conference (C)/ Journal (J)	Research method	Empirical (E)/non-empirical (NE)	Country/ region	Techno-logy
P1	2017	J	Survey	E	Ghana	m-health
P2	2017	J	Survey	E	Ghana	EHR
P3	2017	J	Survey	E	India	EHR
P4	2017	C	SLR	NE	Overall countries	EHR
P5	2017	C	SLR	NE	Overall countries	HIS
P6	2018	J	SLR	NE	Developing countries	m-health
P7	2017	J	SLR	NE	Sub-Saharan Africa	EHR
P8	2017	C	SLR	NE	Developing countries	HIS
P9	2018	J	SLR	NE	Latin Ameri-can's developing countries	Internet of medical things
P10	2017	J	DSR	E	Bangladesh	Health data integration
P11	2017	C	DSR	E	Sub-Saharan Africa	Virtual clinics

each category has been computed as follows:

Percentage = (N*100)/all primary studies

N is the number of studies that specifically addressed that category.

The constant value for "total number of primary studies" is 11, though.

Education, instruction, and knowledge

Lack of literacy, education, and training: Among the prevailing barriers, education and training emerged as the most frequently cited hindrance, as identified by six of the eleven studies. The issue of illiteracy looms prominently across various developing nations. Insufficient education and training tend to engender diminished enthusiasm for embracing new technologies. This educational deficit is a primary obstacle in implementing Electronic Health Records (EHR) effectively, as noted in Study P4. Furthermore, the significance of training cannot be understated in the context of EHR acceptance, as evidenced by Study P7, which highlights that comprehensive training provided to end users of EHRs can significantly enhance the likelihood of their acceptance. Inadequate training and limited knowledge represent recurrent challenges in technology adoption, as corroborated by Studies P4, P7, P9, and P11.

Lack of computer skills: In the developing world, a considerable portion of the population possesses limited computer skills. The dearth of computer literacy is detrimental to technology adoption, as observed in Study P7. This deficiency in computer skills is intricately linked with the resource limitations of individuals, as articulated in Study P4.

Lack of awareness: Within developing countries, there exists a conspicuous lack of awareness concerning the significance of medical technology. Study P4 identifies this absence of awareness as a major impediment, particularly in Electronic Health Records (EHRs) and Electronic Medical Records (EMRs). Similarly, Study P5 underscores that inadequate awareness about technology among the populace hampers the adoption of EHRs. Additionally, the research culture within developing countries has not yet gained substantial prominence, indicating limited research opportunities, as noted in Study P8. This dearth of research opportunities may indicate a lower propensity to embrace technological advancements. In stark contrast, developed nations have embraced research practices as a customary norm, contributing to their commendable adoption rates in health information systems.

Table 9: The frequency of obstacles in first research

Barriers	Source of resource	Freque-ncy
Education, instruction, and knowledge 7 (37%) Lack of knowledge, skills, and literacy a lack of computer skills Lack of awareness importance of EHR and minimal research Inadequate staff	P4, P7, P8, P9 , P10, P11 P4, P7 P4, P5, P8 P4, P8	5 2 3 2
Infrastructure 7 (37%) Network unavailability Insufficient power supply or electricity Lack of centralized healthcare database No unique id like social security number	P1, P4, P5, P8 P1, P5, P7 P4 P10	4 3 1 1
Financial supports 7 (37%) Lack of funds or health systems financing DeficiencyUncertainty of return of investment (ROI) Initial investment and other costing	P2, P8, P9, P11 P3, P4, P11 P3, P4 P4, P7	4 2 3 1
System quality 5 (26%) Data reliability Lack of core features Data security	P2, P4, P5 P4, P5, P6, P11 P2, P4, P5	3 4 3
Culture and political issues 4 (21%) Lack of technological knowledge and a negative attitude towards it There is no national policy on ICTs and mobile health Political issues No local language Overpopulation	P1, P4, P8 P5, P8, P4, P8 P5P8	3 2 2 1 1
Resistance and support unwillingness 3 (16%) Resistance from physicians Lack of future support from vendors Lack of systems maintenance Lack of project planning	P3, P4, P7 P4 P4 P4	3 1 1 1

Infrastructure

Network Inaccessibility: A prime example of infrastructure-related obstacles affecting the implementation of m-health can be found in the lack of network availability, as elucidated in Study P1. According to Study P4, network resources include a variety of technologies, such as twisted pair cables, fiber optic cables, cellular networks, and satellite wireless technology. Insufficient internet connectivity further compounds these challenges, particularly in remote regions, resulting in data transmission difficulties, as in Study P5. The presence of robust network infrastructure considerably facilitates adopting m-health practices, a situation more commonly encountered in developed nations, as posited in Study P5. Conversely, the absence of network availability emerges as a substantial predicament thwarting health technology adoption within developing countries, as emphasized in Study P8.

Power Shortages: Another significant impediment lies in the inadequate electrical power supply. Numerous studies, including P1, P5, and P7, have duly identified the issue of insufficient electricity. Study P1 specifically designates this challenge as an infrastructural barrier to implementation. Frequent power outages, such as those commonly experienced in Bangladesh, create an exceedingly challenging environment for ensuring consistent power availability, as noted in Study P5. The scarcity of electricity stands as a formidable hurdle at the grassroots level in adopting m-health within developing nations, a challenge that necessitates an ongoing effort to provide a stable power supply, as reiterated in Study P7. In Sub-Saharan Africa, power shortages have prevented continuous Electronic Health Records (EHRs) utilisation for extended periods, as corroborated in Study P7.

Absence of Centralized Healthcare Databases: It is a prevailing circumstance in developing nations, including Bangladesh that centralized healthcare databases are generally lacking. This dearth of a centralized healthcare

database can pose a substantial barrier to healthcare technology adoption, as underscored in Study P7.

Financial supports

Inadequate Financial Resources for Healthcare Systems: A recurring theme in numerous studies, including P2, P8, P9, and P11, is the limitation of financial funding as a constraint within the healthcare sector, particularly when implementing Information Systems (IS) projects. Financial constraints are widely acknowledged as significant challenges in developing countries striving to adopt patient-centric healthcare practices, as emphasized in Study P8. An illustrative case from Ghana serves to underscore this issue, where one hospital faced constraints in customizing various aspects of their existing Electronic Medical Record (EMR) systems due to insufficient funding, as reported in Study P2. As previously mentioned in the problem statement, Bangladesh allocated a mere 5% of its budget to healthcare, further compounding the financial constraints.

Economic Shortcomings: Another prominent challenge in advancing telemedicine in Africa is economic deficiency, a concern elucidated in Study P11. The inability to secure the necessary capacity for implementing and contracting for an Electronic Health Record (EHR) represents a significant barrier to effectively utilising health information systems, as delineated in Study P3.

Initial Investment and Associated Costs: The limited adoption of Electronic Health Records (EHRs) can be attributed to the high initial investment costs and additional expenses related to training and ongoing support, as elucidated in Study P7. These initial and implementation costs fall under procedural resource barriers, as outlined in Study P4. The weight of these initial investments and implementation costs looms large, emerging as pivotal barriers to adopting Health Information Systems (HIS), a recurring theme across the reviewed literature.

Cultural and political issues

Unfamiliarity with Technology and Technology Acceptance Culture: The World Health Organization (WHO) has underscored the pivotal role of user acceptance in adopting m-health, with attitudes towards devices significantly shaping user behaviour and technology acceptance, as evidenced in Study P1. Numerous studies have delved into the cultural barriers intertwined with technology adoption. Study P4 has posited that embracing Electronic Health Record (EHR) technology necessitates a cultural shift According to Study P8, different cultural viewpoints may make it more difficult for developing countries to implement patient-centered healthcare systems.

Overpopulation: Study P8 raised the problem of overpopulation as a barrier to developing patient-centred healthcare services in emerging nations.

Reticence and Reluctance to Offer Support

Lack of Future Vendor Support: As seen in Study P4, adopting Electronic Health Records (EHRs) might be hampered by a lack of future vendor support.

Lack of System Maintenance: As described in Study P4, a lack of system maintenance jeopardises the successful adoption of EHRs.

Lack of Project Planning: According to Study P4, inadequate project planning may hinder the introduction of EHR systems.

In summarizing the non-numerical data, it is seen that lack of education, training and literacy is a major barrier to implementing the HIS. Secondly, lack of computer skills is another vital challenge from the user's perspective. Thirdly, a lack of awareness of the HIS is yet another hindrance. Fourthly, the inadequacy of well-trained manpower for implementing the HIS all around the healthcare sector from urban and rural perspectives.

Fifthly, infrastructural capacity aligned with the internet network facility adequacy of power supply puts a big question on implementing the HIS. Sixthly, the lack of a centralized and accurate database is considered a major hurdle, as it is the starting point of implementation after ensuring sufficient allocation of the national budget for providing the HIS.

Finally, there is a lack of acceptance awareness of the technology-based information across the nation for the acceptance and availability of the HIS.

Recommendation for Successful IS Implementation in Healthcare in Developing Countries

Implementing Information Systems (IS) in healthcare settings in developing countries is a critical step toward improving healthcare delivery and outcomes. However, the identified barriers highlight the complex challenges

that must be addressed for successful IS implementation. To overcome these barriers and promote the effective adoption of IS in healthcare, we recommend the following strategies:

1. **Infrastructure Improvement**:

- Governments and healthcare organizations in developing countries should invest in upgrading and maintaining the necessary technological infrastructure, including hardware, software, and network capabilities. This will provide a solid foundation for IS implementation.

2. **Financial Support**:

- To secure the financial resources needed for IS implementation, seek funding from various sources, including government grants, international aid, and public-private partnerships. Efficient budget allocation and financial planning are crucial.

3. **Education, Training, and Awareness**:

- Develop comprehensive education and training programs for healthcare professionals to enhance their digital literacy and skills in utilizing IS. These programs should be tailored to the workforce's specific needs and literacy levels.

4. **System Quality**:

- Prioritize the selection of high-quality IS solutions that align with the unique requirements of healthcare settings in developing countries. Involve end-users and healthcare professionals in the selection and design process to ensure system functionality meets their needs.

5. **Culture and Political Issues**:

- Address cultural and political barriers through diplomatic and governance initiatives. Promote transparency, accountability, and ethical practices within healthcare organizations. Engage local communities and healthcare stakeholders to build support for IS implementation.

6. **Resistance and Support Unwillingness**:

- Implement change management strategies that acknowledge and address the concerns of healthcare providers and staff. Offer support mechanisms, including clear communication, training, and incentives, to encourage the acceptance and adoption of IS solutions.

7. **Long-Term Planning**:

- Develop a long-term strategic plan for IS implementation considering the region's political, social, and economic context. This plan should include scalability and sustainability considerations.

8. **Collaboration**:

- Foster collaboration between government agencies, healthcare organizations, international partners, and non-governmental organizations to pool resources, share best practices, and collectively work toward the successful implementation of IS in healthcare.

9. **Research and Data-Driven Decision-Making**:

- Invest in research to understand the region's specific healthcare needs and make data-driven decisions for IS implementation. This approach will help tailor solutions to the unique challenges of the healthcare system.

10. **Capacity Building**:

- Focus on building local capacity in technology, healthcare management, and policy development to ensure the self-sustainability of IS initiatives in the long run.

Successful IS implementation in healthcare in developing countries is a complex endeavor, but addressing these recommendations can help overcome the identified barriers and improve healthcare delivery, patient outcomes, and overall healthcare system efficiency. These efforts will contribute to bridging the healthcare technology gap and ultimately lead to better healthcare services for the population.

Direction for Future Research

To enhance the applicability of the findings and advance our understanding of HIS adoption in developing countries, future research should consider empirical studies for validation and further insights. Additionally, conducting surveys to assess the failure rate of HIS in specific developing countries, such as Bangladesh, would provide a deeper understanding of the unique challenges faced by each region. This research can be instrumental in shaping more targeted strategies and interventions to overcome the barriers and drive successful HIS implementation in the diverse healthcare landscapes of developing countries.

Conclusion

This paper conducted a systematic literature review (SLR) to comprehensively examine the landscape of health information systems (HIS) implementation in developing countries. Analyzing 11 primary studies from developing countries, this research has provided valuable insights into the challenges, barriers, and success factors associated with HIS adoption in healthcare settings.

The results of this study have underlined several significant barriers that inhibit the successful implementation and adoption of HIS in developing countries. Notably, barriers such as the lack of education, limited network availability, power supply issues, insufficient funding, and user resistance were frequently identified as factors contributing to the low adoption rates of HIS in these regions. It is important to recognize that addressing these barriers is a complex, long-term endeavor, and their persistence is often exacerbated by the limited research scope in developing countries. Furthermore, political issues, especially corruption, have emerged as formidable obstacles to HIS implementation, highlighting the need for strong governance and anti-corruption measures.

In conclusion, the journey towards effective HIS implementation in developing countries is marked by complex challenges, but this thesis has shed light on the critical areas that demand attention. It is hoped that future research and collaborative efforts will contribute to bridging the healthcare technology gap and ultimately improving healthcare outcomes for the populations of these countries.

References

1. Hamed, S., El-Bassiouny, N., & Ternès, A. (2017). Evidence-Based Design and Transformative Service Research application for achieving sustainable healthcare services: A developing country perspective. *Journal of Cleaner Production*, ***140*:**1885-1892.
2. Hassan MZ, Fahim SM, Zafr AH, Islam MS, Alam S. (2016). Healthcare Financing in Bangladesh: Challenges and Recommendations. *Bangladesh Journal of Medical Science*, **15(**4), 505–510. https://doi.org/10.3329/bjms.v15i4.21698 .
3. Krishna, S., & Walsham, G. (2005). Implementing public information systems in developing countries: Learning from a success story. *Information Technology for Development*, **11**(2), 123-140.
4. Bukachi, F., & Pakenham-Walsh, N. (2007). Information technology for health in developing countries. *Chest Journal*, **132**(5), 1624-1630.
5. Walsham, G., & Sahay, S. (2006). Research on information systems in developing countries: Current landscape and prospects. *Information Technology for Development*, **12**(1), 7-24.
6. Kitchenham, B., & Charters, B. (2007). Systematic literature reviews in software engineering – A systematic literature review. *Tech. Rep. EBSE, Keele University and Durham University Joint Report,* Staffordshire, UK.
7. Salama, R., Al-Turjman, F., Aeri, M., & Yadav, S. P. (2023, April). Intelligent Hardware Solutions for COVID-19 and Alike Diagnosis-A survey. In *2023 International Conference on Computational Intelligence, Communication Technology and Networking (CICTN)* (pp. 796-800). IEEE.
8. Angus, A., & Westbrook, G. (2019). Top 10 global consumer trends. *Euromonitor International: London, UK*.
9. Farzana, F. D., Rahman, A. S., Sultana, S., Raihan, M. J., Haque, M. A., Waid, J. L., & Ahmed, T. (2017). Coping strategies related to food insecurity at the household level in Bangladesh. *PloS one*, **12**(4), e0171411.
10. Sohel, M. S., Ehsan, S. M. A., Zaman, N. T., Hossain, B., Shi, G., Sarker, M. N. I., & Ali, H. M. (2022). Understanding rural local government response during COVID-19-induced lockdown: Perspective from Bangladesh. *SN Social Sciences*, **2**(10), 216.
11. Shammas, L., Zentek, T., von Haaren, B., Schlesinger, S., Hey, S., & Rashid, A. (2014). Home-based system for physical activity monitoring in patients with multiple sclerosis (Pilot study). *Biomedical engineering online*, **13,** 1-15.
12. Safdar, M., Rehman, S. U., Arif, M., & Ashiq, M. (2023). Research data services in libraries: a systematic literature review. *Information Discovery and Delivery*, **51(**2), 151-165.
13. Chowdhury, M. H. H. (2020). Opportunities of Institutional Repositories in Bangladesh: An Overview. *The Eastern Librarian*, **25**(1), 110-128. https://lab.org.bd/wp-content/uploads/2020/08/07_v25n1_hossam.pdf
14. Nomani, M. Z. M., & Parveen, R. (2021). COVID-19 pandemic and disaster preparedness in the context of public health laws and policies. *Bangladesh Journal of Medical Science*, **20**(5), 41–48. https://doi.org/10.3329/bjms.v20i5.55405
15. Xiong J, Lipsitz O, Nasri F, Lui LMW, Gill H, Phan L. Since January 2020 Elsevier has created a COVID-19 resource centre

with free information in English and Mandarin on the novel coronavirus COVID- 19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information. J Affect Disord. 2020;**277**(January):55–64.

16. Nochaiwong S, Ruengorn C, Thavorn K, Hutton B, Awiphan R, Phosuya C, et al. Global prevalence of mental health issues among the general population during the coronavirus disease-2019 pandemic: a systematic review and meta-analysis. Sci Rep [Internet]. 2021;**11**(1):1–18. Available from: https://doi.org/10.1038/s41598-021- 89700-8
17. Opanasenko, A., Lugova, H., Mon, A. A., & Ivanko, O. (2021). Mental Health Impact of GenderBased Violence Amid COVID-19 Pandemic: A Review. Bangladesh Journal of Medical Science, **20**(5), 17–25. https://doi.org/10.3329/bjms.v20i5.55396
18. Mahmood, AK, Rahman, S., Ahmad, AUF, Akter, T., Haque, A., Afrin, FS., Huda, N., Sobhani, FA. (2023). CSR to Tackle the Economic Effect of Covid-19: The Case of Bangladesh. *Bangladesh Journal of Medical Sciences*, **22**(1), 154–162. https://doi.org/10.3329/bjms.v22i1.61868 .
19. Okoli, C., Schabram, K. (2010). "A Guide to Conducting a Systematic Literature Review of Information Systems Research,". *Sprouts: Working Papers on Information Systems*, **10**(26). http://sprouts.aisnet.org/10-26
20. Rai, R., Sahoo, G., & Mehfuz, S. (2015). Exploring the factors influencing cloud computing adoption: a systematic study on cloud migration. *SpringerPlus*, **4**(1), 197.
21. Braa, J., Hanseth, O., Heywood, A., Mohammed, W., & Shaw, V. (2007). Developing health information systems in developing countries: the flexible standards strategy. *MIS Quarterly*, 381-402.
22. Kimaro, H., & Nhampossa, J. (2007). The challenges of sustainability of health information systems in developing countries: comparative case studies of Mozambique and Tanzania. *Journal of Health Informatics in Developing Countries*, **1**(1).
23. Kitchenham, B. (2004). Procedure for undertaking systematic reviews. *Computer Science Department, Keele University (TRISE-0401) and National ICT Australia Ltd (0400011T. 1), Joint Technical Report*
24. Sheuly, S. (2013). A systematic literature review on agile project management. Lappeenranta University of Technology.
25. Chikumba, P. A. (2017, May). Exploring integrative approach of GIS implementation: The case of GIS in health management in Malawi. In *IST-Africa Week Conference (IST-Africa), 2017* (pp. 1-9). IEEE.
26. Aamir, J., Ali, S. M., Boulos, M. N. K., Anjum, N., & Ishaq, M. (2018). Enablers and inhibitors: A review of the situation regarding mHealth adoption in low-and middle-income countries. *Health Policy and Technology, 7*(1), 88-97.
27. Brinkel, J., Dako-Gyeke, P., Krämer, A., May, J., & Fobil, J. N. (2017). An investiga- tion of users' attitudes, requirements and willingness to use mobile phone- based interactive voice response systems for seeking healthcare in Ghana: a qualitative study. *Public Health, 144*, 125-133.
28. Faruk, N., Surajudeen-Bakinde, N. T., Oloyede, A. A., Bello, O. O., Popoola, S. I., Ab- dulkarim, A., & Olawoyin, L. A. (2017, December). On green virtual clinics: A framework for extending healthcare services to rural communities in Sub- Saharan Africa. In *Rural and Elderly Health Informatics Conference (IREHI), 2017 International* (pp. 1-7). IEEE.
29. Gesulga, J. M., Berjame, A., Moquiala, K. S., & Galido, A. (2017). Barriers to Electron- ic Health Record Systems Implementation and Information Systems Re- sources: A Structured Review. *Procedia Computer Science, 124*, 544-551.
30. Gyamfi, A., Mensah, K. A., Oduro, G., Donkor, P., & Mock, C. N. (2017). Barriers and facilitators to Electronic Medical Records usage in the Emergency Centre at Komfo Anokye Teaching Hospital, Kumasi-Ghana. *African Journal of Emergency Medicine,* 7(4), 177-182.
31. Khan, S. I., & Hoque, A. S. M. L. (2017, January). Health data integration with Secured Record Linkage: A practical solution for Bangladesh and other developing countries. In *Networking, Systems and Security (NSysS), 2017 International Conference on* (pp. 156-161). IEEE.
32. Luna-delRisco, M., Palacio, M. G., Orozco, C. A. A., Moncada, S. V., Palacio, L. G., Montealegre, J. J. Q., & Diaz-Forero, I. (2018, June). Adoption of Internet of Medical Things (IoMT) as an opportunity for improving public health in Latin America. In *2018 13th Iberian Conference on Information Systems and Tech- nologies (CISTI)* (pp. 1-5). IEEE.
33. Mohamadali, N. A., & Ab Aziz, N. F. (2017). The Technology Factors as Barriers for Sustainable Health Information Systems (HIS)–A Review. *Procedia Comput- er Science, 124*, 370-378.
34. Odekunle, F. F., Odekunle, R. O., & Shankar, S. (2017). Why sub-Saharan Africa lags in electronic health record adoption and possible strategies to increase its adoption in this region. *International Journal of Health Sciences, 11*(4), 59.
35. Pankomera, R., & van Greunen, D. (2017, May). Mitigating vulnerabilities and threats for patient-centric healthcare systems in low income developing countries. In *IST-Africa Week Conference (IST-Africa), 2017* (pp. 1-11). IEEE.
36. Powell, A. C., Ludhar, J. K., & Ostrovsky, Y. (2017). Electronic health record use in an affluent region in India: Findings from a survey of Chandigarh hospi- tals. *International Journal of Medical Informatics, 103*, 78-82.